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The Collaboration on Attachment Transmission Synthesis

Published in:
Child Development

DOI:
10.1111/cdev.13085

Publication date:
2018

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
The Collaboration on Attachment Transmission Synthesis (2018). Examining Ecological Constraints on the Intergenerational Transmission of Attachment Via Individual Participant Data Meta-analysis. *Child Development*, *89*(6), 2023-2037. https://doi.org/10.1111/cdev.13085

CHILD DEVELOPMENT

Child Development, November/December 2018, Volume 89, Number 6, Pages 2023–2037

The title for this Special Section is **Meta-analysis and Individual Participant Data Synthesis in Child Development**, edited by Glenn I. Roisman and Marinus H. van IJzendoorn

Examining Ecological Constraints on the Intergenerational Transmission of Attachment Via Individual Participant Data Meta-analysis

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Parents' attachment representations and child–parent attachment have been shown to be associated, but these associations vary across populations (Verhage et al., 2016). The current study examined whether ecological factors may explain variability in the strength of intergenerational transmission of attachment, using

The members of Collaboration on Attachment Transmission Synthesis are provided in Appendix.
This work was supported by a grant from Stichting tot Steun Nederland to Mirjam Oosterman and Carlo Schuengel and a grant from the Social Sciences and Humanities Research Council Canada (grant number 430-2015-00989) to Sheri Madigan. We are also grateful for the financial support that enabled researchers to carry out the original studies of which the data are included in this work. None of the authors have any conflicts of interest to disclose.
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0009-3920/2018/8906-0008
DOI: 10.1111/cdev.13085

individual participant data (IPD) meta-analysis. Analyses on 4,396 parent–child dyads (58 studies, child age 11–96 months) revealed a combined effect size of r = .29. IPD meta-analyses revealed that effect sizes for the transmission of autonomous-secure representations to secure attachments were weaker under risk conditions and weaker in adolescent parent–child dyads, whereas transmission was stronger for older children. Findings support the ecological constraints hypothesis on attachment transmission. Implications for attachment theory and the use of IPD meta-analysis are discussed.

One of the core hypotheses of attachment theory is that patterns of attachment are transmitted from one generation to the next. The idea is that attachment experiences are transmitted in this way due to the formation of internal working models and the shaping of these models with each new attachment experience that arises from the developing relationship with the parent (Bowlby, 1969/1982). In adulthood, attachment-relevant information is organized in a mental representation of attachment, defined as "a set of conscious and/or unconscious rules for the organization of information relevant to attachment and for obtaining or limiting access to that information" (Main, Kaplan, & Cassidy, 1985, p. 67). These attachment representations are believed to guide the behavior of adults when they enter new attachment relationships, for instance when caring for their own children, and have been shown to be associated with the quality of their attachment relationships with their children (Main et al., 1985). Extant research on this topic measures attachment in very different ways in one generation than the other, so it may be debated whether this truly reflects "transmission" of the same qualities from parent to child, rather than one parental characteristic predicting another in the child. Nevertheless, the term "intergenerational transmission" has become the convention when the association between parent attachment representation and child–parent attachment relationship is examined.

Initially, attachment transmission studies involved mostly homogeneous, low-risk samples. A meta-analysis of this first set of studies concluded that the association between quality of parents' attachment representation and quality of parent–child attachment relationships was robust across studies, with a large effect size of r = .47 (Van IJzendoorn, 1995). Studies conducted subsequently were more demographically heterogeneous, including samples at heightened psychosocial risk (e.g., Sherman, 2009), preschool age children rather than infants, and nonbiologically related parent–child dyads (e.g., Bernier & Dozier, 2003). Apart from the association between parental attachment representations and child–parent attachment, several studies also assessed a potential genetic contribution to attachment in infants and toddlers, but found little evidence for such a component, both in behavioral genetic studies and in molecular-genetic studies (for an overview, see Bakermans-Kranenburg & Van IJzendoorn, 2016), although a twin study with adolescents did show substantial heritability of attachment representations (Fearon, Shmueli-Goetz, Viding, Fonagy, & Plomin, 2014). Overall, studies on heritability suggest that intergenerational transmission of attachment may be mainly through parenting, as evidenced by a behavior-genetic study on the association between sensitivity and attachment (Fearon et al., 2006).

To arrive at a comprehensive test and thorough understanding of intergenerational transmission, a new meta-analysis was conducted more than 30 years after the original finding was published, including published and unpublished effect sizes for intergenerational transmission (Verhage et al., 2016). This synthesis of 95 samples showed that the intergenerational transmission of attachment was statistically significant (r = .31), but notably smaller in magnitude than that found in Van IJzendoorn's (1995) meta-analysis 2 decades earlier, with the explained variance decreasing substantially from approximately 25% in 1995 to roughly 9% in 2016. Attachment transmission, therefore, appeared to be less clearcut than it initially seemed. For example, attachment transmission was weaker in samples with known risks (e.g., teenage mothers, parents with psychopathology, socioeconomically stressed families, and preterm born children) and stronger when attachment was measured beyond the infancy period. Verhage and colleagues pointed to possible contextual and individual factors that might mitigate the effect of parents' attachment representations on child–parent attachment. In this article, we explore one possible subset of those factors, namely ecological constraints, leveraging the statistical power of an individual participant data (IPD) meta-analysis, in a novel method in developmental science of collating and analyzing raw data from individual studies.

Could Ecological Constraints Restrict Attachment Transmission?

Under some circumstances, ecological constraints may mitigate the association between attachment representations and the child–parent attachment relationship. Sagi et al. (1997) were the first to discover this phenomenon, when they compared attachment transmission in two samples of kibbutz communities, one in which children slept communally and one in which children slept at their parents' homes. Communal sleeping restricts primary attachment figures' availability to day-time only. Attachment transmission was weaker under conditions of communal sleeping arrangements. Communal sleeping was a rather unique proximal factor that directly limited the availability of the attachment figure during the potentially stressful night time. Distal factors may also indirectly constrain the physical or emotional availability of attachment figures, leaving less room for the parents' attachment representation to influence the quality of child–parent attachment. The following paragraphs discuss more common distal factors that may indirectly weaken attachment transmission. The interest in these factors is not focused on main effects on parental attachment representation nor on child–parent attachment, but due to their weakening effect on intergenerational transmission of attachment.

Risk Background

Various risk factors affect parents' emotion regulation systems and their attentional systems, resulting in less sensitive and more disruptive caregiving (e.g., Cyr, Euser, Bakermans-Kranenburg, & van IJzendoorn, 2010). This may happen even for parents with autonomous-secure attachment representations, blocking the pathway toward secure child–parent attachment through sensitive caregiving. Parent-related risks, such as teenage motherhood, parental psychopathology, and hardship, might affect attachment transmission differently than child-related risks, such as preterm birth and health problems, because parents may be able to circumvent the constraints imposed by child risk factors (such as communicative disabilities), whereas constraints imposed by parents' own situation or characteristics more directly interfere with their abilities to engage in sensitive caregiving that would otherwise follow from an autonomous-secure attachment representation (Van IJzendoorn, Goldberg, Kroonenberg, & Frenkel, 1992).

Parental Education

Very low parental education levels (i.e., less than a high school education) are linked through socioeconomic disadvantages to stress at the family level (Conger et al., 2002), affecting attachment transmission in a way similar to risk factors. Earlier work has shown that education level was not associated with attachment representations (Bakermans-Kranenburg & Van IJzendoorn, 1993), but it was one of the most important predictors of sensitivity in parents (Biringen et al., 2000).

Relationship Status

Single parenthood is often described as more challenging than shared parenthood as a result of economic and time constraints that can undermine single parents' capacity to attune to child cues and signals (Cyr et al., 2010). Moreover, studies have shown that partner support, especially emotional support, decreased parenting stress during the first year postpartum (Sampson, Villarreal, & Padilla, 2015) and that marital adjustment moderated the association between attachment representations and child attachment (Das Eiden, Teti, & Corns, 1995). High stress levels of single parents may, thus, compromise sensitive responding and transmission of parents' autonomous attachment representation.

Adolescent Parenting

Becoming a parent at a young age may pose specific challenges, because developmental issues of adolescence (Sroufe, Egeland, Carlson, & Collins, 2009) may compete with attention to the child needs. Thus, being a very young parent might override the attachment transmission typically driven by parental adult attachment representations, as was shown recently by Bailey, Tarabulsy, Moran, Pederson, and Bento (2017).

Age of the Child

Verhage et al. (2016) showed that attachment transmission was weaker in younger than in older children. However, related but distinct factors such as the way attachment security was measured (e.g., Main–Cassidy Classification System (Main & Cassidy, 1988) instead of the Strange Situation Procedure (SSP; Ainsworth, Blehar, Water, & Wall, 1978)) and the older age of the parents may have confounded the moderating effect of child age for attachment transmission. Still, increases in impact of parental attachment representation on the parent–child relationship with child age would be consistent with Bowlby's (1969/1982) internal working models account of attachment, because such models take shape gradually over time, in transaction with the environment. This moderator effect would be slightly different than for the other ecological constraints, as the increasing age and resulting amount of dyadic experience would facilitate the transmission in both expected directions (i.e., autonomous to secure and nonautonomous to insecure).

Sex of the Parent

Although attachment transmission was weaker for fathers than mothers in the first meta-analysis in this area (Van IJzendoorn, 1995), this moderator did not emerge as significant in the more recent meta-analysis (Verhage et al., 2016). Specifically, in the recent meta-analysis, the strength of attachment transmission for mothers has reduced, whereas it has remained stably moderate for fathers. Secular trends in many countries have led to an increase in dual-earner families, meaning that mothers in newer cohorts on average spend less time at home with their children than in the past (Doucet, 2015). Similar to child age, parental sex would be expected to affect the transmission of autonomous-secure and nonautonomous-insecure representations similarly.

The Current Study

The current study opted for a meta-analysis on the basis of IPD. IPD meta-analysis involves obtaining, accumulating, and synthesizing raw data from all participants in every study on a particular topic (Riley, Lambert, & Abo-Zaid, 2010). IPD may answer research questions in a more nuanced and powerful manner than traditional meta-analysis, as traditional meta-analysis is limited to the study-level aggregate data as published, whereas IPD meta-analysis adds the level of participant data (and thus within-study variation) to the analyses using multilevel techniques.

IPD meta-analysis has several advantages over traditional meta-analysis. First, the meta-analyst can use more data than reported in the original manuscripts, especially moderator, mediator, and control variables. Not only is traditional meta-analysis limited by the number of associations that primary studies report in sufficient detail, but often individual variation and thus information is reduced to a summary value for the study sample, such as proportion of males or mean age. The number of analytic options beyond the focal effect size under study is much larger in IPD meta-analysis, not only because typically more variables are available but also because the data may be cast in a multilevel framework with individual records nested within studies, allowing the test of structural models that simultaneously include variables at the individual level (such as child age) and variables at the study level (such as type of instrument used to assess attachment). Finally, modeling effects over participants instead of over studies greatly increase the power of moderator analyses (e.g., Riley et al., 2010), especially when error rates for testing multiple moderators are properly controlled. Despite the more time-intensive nature of IPD meta-analyses and the fact that typically less data can be retrieved from study authors due to nonresponse or lack of availability data, calls have been made to shift focus from aggregate data meta-analysis to IPD meta-analysis because of its higher potential for credible findings (Ioannidis, 2017).

This IPD meta-analysis tested the hypothesis that dyads exposed to stress-increasing risk factors, and dyads with very low educated, single, or adolescent parents, would show weaker transmission of autonomous-secure representation to secure attachment than dyads without these ecological constraints. Furthermore, based on the idea that interaction patterns consolidate over time, we tested whether dyads containing older children and dyads with mothers (as opposed to fathers) would show greater attachment transmission, controlling for potential confounders such as type of attachment assessment and age of the parent.

Method

In conducting and reporting of this IPD meta-analysis, we have adhered to the Preferred Reporting Items for Systematic Reviews and Meta-analysis of Individual Participant Data (PRISMA-IPD) statement (L. A. Stewart et al., 2015).

Study Identification and Selection

This IPD meta-analysis built on the conventional meta-analysis by Verhage et al. (2016). Authors of all eligible studies were invited to contribute their data sets and participate in the Collaboration on Attachment Transmission Synthesis (CATS). For detailed information on the study identification and selection process and the data collection, we refer to Appendix S1.

Data Items

Authors were asked to provide demographic data, including parental education, relationship status, parental age and sex, child age and sex, and psychosocial (e.g., poverty) and medical risk (e.g., preterm birth) history. These demographic data were measured at the time of first attachment assessment (i.e., Adult Attachment Interview [AAI; Main, Kaplan, & Cassidy, 1985] or child–parent attachment), except for child age, which was measured at the time of the child–parent attachment assessment. Furthermore, authors contributed data on our focal variables, parental attachment representations, and child–parent attachment. Authors supplied the data either in a pre-specified standardized format in SPSS or Excel, or other formats, which the first author (MLV) standardized accordingly after which she sent the data set back to the author for a quality check. Several study-level variables were also extracted from the articles (year[s] of data collection, training of the attachment coders, and interrater reliability). If these data could not be extracted, authors were contacted.

Data Verification

All data were checked for anomalies. Descriptive statistics were, together with cross tabulations of the attachment categories, compared with the data reported in the publications or unpublished manuscripts for each study. In the few cases that inconsistencies were noted, authors were contacted and discrepancies were resolved.

Data Collation

In the final step, individual participant data sets were merged (final N for analyses = 4,396). Demographic data were as follows: 3,982 (91%) of the parents were female, 2,213 (51%) of the children were male. The mean age of the parents was 29.9 years (SD = 7.2), 548 (12%) parents were younger than 21 years, and 779 (17%) of the parents were single. Children were on average 14.5 months old (SD = 22.3) at parental attachment representation assessment (1,612 pre-birth assessments) and 18.6 months old (SD = 13.0) at child–parent attachment assessment. A total of 854 parents (21%) finished only primary school or less, whereas 3,644 (79%) of the parents completed secondary education or higher, and 2,083 (46%) of the dyads were considered "at-risk." Studies originated from 15 countries and data collection took place from 1986 to 2013.

IPD Synthesis Methods

All studies in this IPD meta-analysis included an observational attachment measure as the outcome variable. If a study reported on multiple child–parent attachment measures, preference was given to Strange Situation classifications, because this measure has been most widely used and tested. For our purposes, attachment categories were grouped into secure and insecure attachment, with the avoidant and resistant attachment categories collapsed into one insecure category and primary disorganized classification disregarded (using the "forced" secondary classifications instead). Cannot Classify cases were included in the insecure category. If studies reported only Attachment Q-Sort (AQS; Waters & Deane, 1985) data, scores were recoded as Secure/Insecure with scores > 0.40 considered secure, consistent with previous research (Lehman, Denham, Moser, & Reeves, 1992).

Handling Missing Data

First, we imputed missing values on the demographic variables separately within each study with multiple imputation. The first imputed value was retained to keep the N of the studies the same. For variables with missing values for the entire study, cases of this study were matched on demographics with cases of other studies and the missing values were imputed based on the values of the matched cases. Second, the missing data on attachment representations and child–parent attachment were imputed with multiple imputation within each study separately. The first imputed value was retained, after which the files were combined into the large data set. All analyses were performed both with the imputed data set and with the smaller data set including only dyads with complete data, as a sensitivity analysis for differential effects in complete and imputed data.

Analyses

Imputations and analyses were performed with STATA statistical software, version 14.1 (StataCorp LP, College Station, TX). We conducted random effects one-stage IPD meta-analysis while accounting for the clustering of parent–child dyads within studies. In one-stage IPD meta-analysis, IPD of all studies are analyzed in a single step by using a multilevel structure to account for the variance within studies. Although results of two-stage IPD meta-analyses, in which analyses are first performed for each study and then combined in a second step, often do not differ from results of one-stage IPD meta-analyses (G. B. Stewart et al., 2012), the one-stage method is preferred to the two-stage method in the case of binary outcomes, because it is more flexible and uses a more precise statistical approach (Debray, Moons, Abo-Zaid, Koffijberg, & Riley, 2013).

As a preliminary analysis, the effect size of intergenerational transmission of autonomous versus nonautonomous attachment representations to secure versus insecure child–parent attachment was analyzed with a multilevel logistic regression model with random effects for intercept and slope variance using the STATA melogit command. In line with our research questions, the moderating effects of at-risk background (yes/no), low education level (primary education or less), relationship status (single/together), adolescent parenting (< 21 years), age of the child at the attachment assessment, and sex of the parent (male/female) were examined. Also, within the at-risk dyads, differences between parental risk (e.g., childhood abuse, parental psychopathology) and child risk (e.g., preterm birth) in the transmission of attachment were tested. Moderator effects were assessed separately for each moderator by adding the moderator and the interaction term between the moderator and parent attachment representations to the multilevel logistic regression model. For categorical moderators, post hoc analyses for each level of the moderator were performed to assess the effect size of intergenerational transmission for each subgroup.

To incorporate the results of the studies that did not provide IPD, we compared the effect sizes and their confidence intervals between studies with and without IPD. For the studies without IPD, effect sizes were recalculated into correlations and their 95% confidence intervals with Comprehensive Meta-analysis software (Borenstein, Hedges, Higgins, & Rothstein, 2014). In a sensitivity analysis, these results were compared with the results of the IPD meta-analysis, in line with recommendations by Riley and Steyerberg (2010).

Finally, as an indication of quality of the attachment assessments, we performed sensitivity analyses for studies in which attachment measures were scored by officially trained coders (yes/no) and for studies in which attachment measures had acceptable interrater reliability (yes/no with a cutoff of $\kappa = .70$). Also, we assessed whether studies with IPD were different from studies without IPD by comparing the year of data collection, demographic characteristics, and quality indicators of intercoder reliability and coder training.

Results

The multilevel logistic regression model with random effects for intercept and slope variance yielded a significant effect size for attachment transmission of the dichotomized forced classifications of $OR = 2.99$, 95% CI [2.26, 3.96], $p < .001$ (equivalent to $r = .29$, 95% CI [.22, .35]), showing that the odds for attachment transmission were three times larger than the odds for nontransmission. Children of parents with autonomous representations ($N = 2{,}311$) were more likely to develop secure attachment ($N = 1{,}612$) than insecure attachment ($N = 699$). Similarly, children of parents with nonautonomous representations ($N = 2{,}085$) were somewhat more likely to develop insecure attachment ($N = 1{,}115$) than secure attachment ($N = 970$). Effect sizes did differ between studies (between-study variance: $OR = 0.77$, 95% CI [0.44, 1.37]), underlining the need for multilevel modeling.

Assessment of the Ecological Constraints on Attachment Transmission

Descriptive statistics of the ecological constraint variables and correlations between the ecological constraint variables are presented in Appendix S2. The intergenerational transmission effect was moderated by risk background ($OR = 0.44$, 95% CI [0.30, 0.64], $p < .001$), such that risk diminished the odds of secure child–parent attachment in the case of parents with autonomous representations (Figure 1a). The combined effect size representing the association between autonomous representation and child security was $OR = 1.66$, 95% CI [1.24, 2.22], $p = .001$ (equivalent to $r = .14$, 95% CI [.06, .21]) for the dyads with a risk background ($N = 2{,}023$), whereas the effect size for dyads without a risk background ($N = 2{,}373$) was $OR = 4.58$, 95% CI [3.18, 6.62], $p < .001$ (equivalent to $r = .39$, 95% CI [.30, .46]). The plot shows that risk did not affect the probability of secure attachment for children of parents with nonautonomous representations (Figure 1a). For parents with an autonomous representation, the probability of child security was substantially higher for low-risk dyads than for high-risk dyads (probability of .78 vs. .60, respectively).

Additional analyses distinguished between parent-related risk and child-related risk. Results showed that both parent risk and child risk weakened the intergenerational transmission of attachment compared with no risk (parent risk: $OR = 0.43$, 95% CI [0.29, 0.64], $p < .001$; child risk:

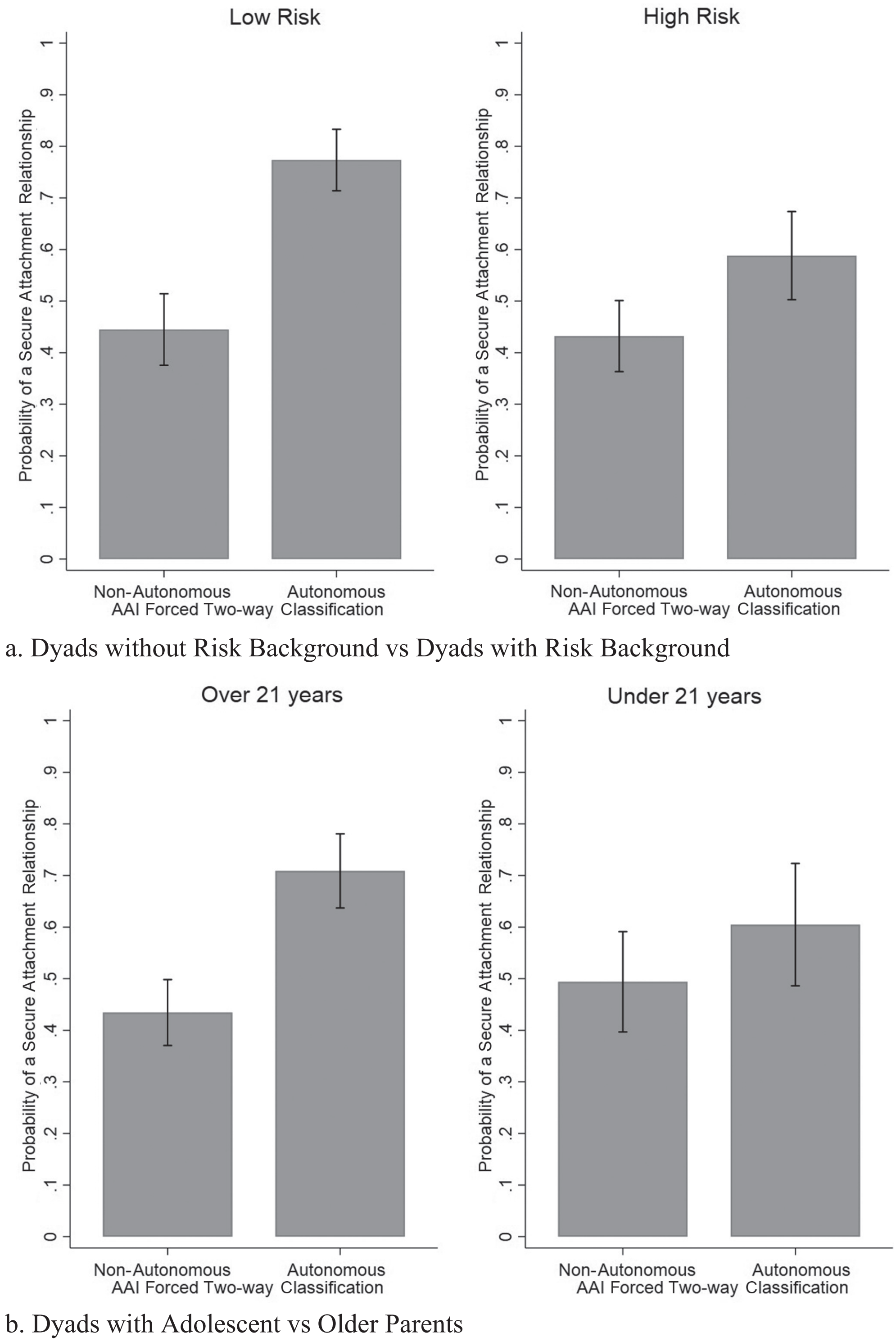

Figure 1. The probability of a secure attachment relationship in risk versus nonrisk groups (a) and adolescent parents versus older parents (b) given autonomous and nonautonomous parental attachment representations. AAI = Adult Attachment Interview.

OR = 0.48, 95% CI [0.25, 0.92], *p* = .03, respectively). Including only risk dyads, the interaction effect between parental attachment representations and parent risk (*N* = 1,506) versus child risk (*N* = 517) was not significant (*OR* = 0.72, 95% CI [0.38, 1.38], *p* = .32), meaning that parent and child risk did not differ in the strength of attachment transmission.

Low education level did not significantly moderate the intergenerational transmission effect (*OR* = 0.70, 95% CI [0.48, 1.03], $p = .07$). The combined effect size representing the association between autonomous representation and child security was *OR* = 1.83, 95% CI [1.24, 2.70], $p = .002$ (equivalent to $r = .16$, 95% CI [.06, .26]) for parents with low education level ($N = 820$), and the effect size for parents with a higher education level ($N = 3{,}576$) was *OR* = 3.10, 95% CI [2.35, 4.11], $p < .001$ (equivalent to $r = .30$, 95% CI [.23, .36]).

Single parenthood did not significantly moderate the intergenerational transmission effect (*OR* = 0.71, 95% CI [0.47, 1.08], $p = .11$). Combined effect size for attachment transmission was *OR* = 1.70, 95% CI [1.13, 2.57], $p = .01$ (equivalent to $r = .14$, 95% CI [.03, .25]) for single parents ($N = 778$), and the effect for two-parent families ($N = 3{,}618$) was *OR* = 3.07, 95% CI [2.29, 4.13], $p < .001$ (equivalent to $r = .30$, 95% CI [.22, .36]).

Intergenerational transmission was weaker among adolescent parents than adult parents (*OR* = 0.49, 95% CI [0.30, 0.81], $p = .006$, see Figure 1b), when controlling for risk background. Post hoc analyses indicated that the attachment transmission was not significant in adolescent parents ($N = 548$), with an *OR* = 1.52, 95% CI [0.90, 2.56], $p = .11$ (equivalent to $r = .11$, 95% CI [−.03, .25]), whereas it was for adult parents (*OR* = 3.14, 95% CI [2.34, 4.22], $p < .001$; equivalent to $r = .30$, 95% CI [.23, .37]; $N = 3{,}848$).

When testing the moderation effect of child age, parental age, and attachment measure were taken into account as covariates. Child age was assessed as a continuous moderator measured in years. The results showed that intergenerational transmission was stronger when children were older than younger (*OR* = 1.45, 95% CI [1.19, 1.76], $p < .001$, see Figure 2). Because the child age variable was highly skewed, we repeated the analyses excluding children over 6 years of age ($N = 86$ from five studies) to test the robustness of this finding, and the effect was similar (*OR* = 1.37, 95% CI [1.08, 1.74], $p < .01$).

Finally, the moderating effect of sex of the parent was investigated. Results showed that the interaction effect between parental attachment representations and sex of the parent was not significant (*OR* = 0.72, 95% CI [0.37, 1.41], $p = .34$), meaning that intergenerational transmission of attachment was not significantly different in strength for mothers and fathers. The effect size for transmission for fathers ($N = 414$) was *OR* = 5.56, 95% CI [2.62, 11.81], $p < .001$ (equivalent to $r = .43$, 95% CI [.26, .56]), and for mothers ($N = 3{,}982$) it was *OR* = 2.95, 95% CI [2.22, 3.94], $p < .001$ (equivalent to $r = .29$, 95% CI [.21, .35]).

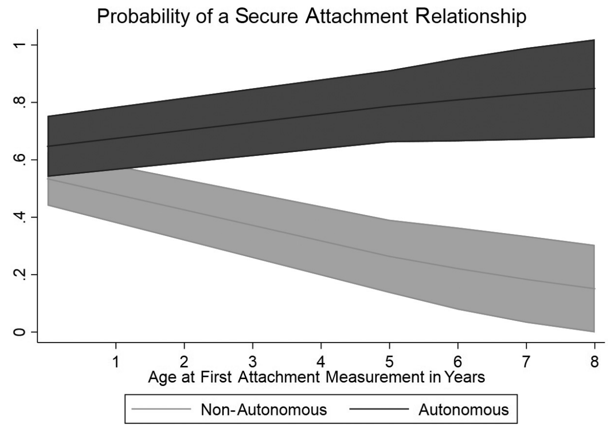

Figure 2. The probability of a secure attachment relationship by age at the first attachment assessment.
Note. Areas around the line represent 95% confidence intervals. This figure contains the estimates taking into account the covariates age of the parent and attachment measure.

All moderator analyses were repeated with the nonimputed data (N ranged from 3,243 to 3,681), which did not materially affect the outcome of hypothesis testing. Furthermore, sensitivity analyses with the data set excluding the Cannot Classify cases ($N = 119$) did not alter findings. Analyses were also repeated with disorganized classifications included in the insecure category, and results were similar to when disorganization was disregarded (see Appendix S3 for all results). Sensitivity analyses with the cutoff for AQS security at 0.30 ($N = 71$ insecure changed into secure) as recommended by Waters (undated work) did not show any different results either. Sensitivity analyses with the study quality variables showed that official coder training of the AAI and SSP did not alter effect sizes for intergenerational transmission ($p = .44$ and $p = .81$, resp.). Interrater reliability for the SSP did not predict attachment transmission ($N = 1{,}672$, $k = 24$; $p = .72$), but for the AAI ($N = 925$, $k = 12$), transmission was significantly more likely when interrater reliability was sufficient (*OR* = 3.49, 95% CI [1.16, 10.53], $p < .03$). In fact, for studies in which interrater reliability was below $\kappa = .70$ ($N = 509$, $k = 5$), the effect size of transmission was *OR* = 1.09, 95% CI [0.68, 1.74], $p = .71$ (equivalent to $r = .02$, 95% CI [−.11, .15]), whereas studies with sufficient interrater reliability ($N = 416$, $k = 7$) had an effect size of *OR* = 4.57, 95% CI [1.78, 11.74], $p < .01$ (equivalent to r = .39, 95% CI [.16, .56]), indicating that the effect size for transmission of attachment partially depends on the interrater reliability of the AAI.

When comparing the results of the studies for which IPD were available (k = 58, N = 4,396) with the results of the studies for which IPD were not available (k = 26, N = 1,104), the overall effect sizes for the intergenerational transmission of attachment were comparable (no IPD: r = .36, 95% CI [.26, .45]; IPD: r = .29, 95% CI [.22, .35], respectively). For an overview of all effect sizes at the study level, see Appendix S1. Results for the moderator analyses also converged, although the effects of risk status and child age at attachment assessment did not reach significance in the set of studies with aggregate data, possibly due to a lack of power and ignoring within-study variation. For a detailed description of these results, see Appendix S4.

Discussion

This IPD meta-analysis on 4,396 parent–child dyads showed that parents with autonomous attachment representations were three times more likely to foster secure attachment relationships with their children than parents with nonautonomous attachment representations. The size of the effect we observed, r = .29 (95% CI [.22, .35]), was almost identical to the one found in the traditional meta-analysis with aggregate data, with largely overlapping confidence intervals (r = .31, 95% CI [.26, .37]; Verhage et al., 2016). Findings of the moderator analyses were consistent with the ecological constraint hypothesis (Sagi et al., 1997), which states that contextual factors hinder parents' ability to tap into their autonomous attachment representations and provide children with experiences conducive to secure attachment relationships. These constraints may act on the potential of parents with autonomous attachment representations to build secure attachment relationships. In families with known risks, the association between autonomous representation of the parent and child attachment security was r = .14, 95% CI [.06, .21], but in families without a risk background, the association was much stronger, r = .39, 95% CI [.30, .46]. Again, these results are remarkably convergent with the meta-analytic findings on risk status (Verhage et al., 2016). However, the IPD meta-analysis added the important new insight that risk status did not alter the odds of children having secure attachment when parents had nonautonomous representations; rather, the odds of secure attachment were lower for parents who had autonomous attachment representations in a high- versus low-risk context. This finding is inconsistent with a cumulative risk model, in which risk status would increase the effect of a nonautonomous attachment representation in the parent on the probability of an insecure attachment relationship. Although it remains to be investigated why a cumulative risk model does not apply in this case, maybe the explanation is a simple floor effect—there is more room for autonomous parents to become insensitive when difficult circumstances "override" their typical caregiving patterns than for nonautonomous parents. Alternatively, children's differential susceptibility to their environment might play a role; some children form secure attachment relationships no matter what the caregiving circumstances, as speculated on evolutionary grounds by Belsky (1997).

In contrast to our hypothesis, there were no significant differences in attachment transmission when risk status was parent- versus child-related. In a previous meta-analysis, risks in the parent, such as depression or poverty, appeared to hinder the emergence of a secure attachment relationship more so than child risks such as physical disabilities (Van IJzendoorn et al., 1992). Theoretically, it was assumed that the adult caregiver could compensate for disabilities in the child by shaping the attachment relationship, whereas the child would not be able to overcome the interactive obstacles raised by parental risk factors. In the current IPD study with a much larger sample and accompanying statistical power, this hypothesis was not supported. An explanation might be that disabilities in the child elicit feelings of stress, anxiety, and depression in the parents, as parents may be responding to the meaning they give to the diagnosis (Marvin & Pianta, 1996). This would also pose an ecological constraint on sensitive responding and thus attachment transmission.

In line with the ecological constraint hypothesis, we found that early parenthood (i.e., giving birth under the age of 21) moderated the association between parent and child attachment. Children of adolescent parents with autonomous attachment representations did not display attachment security as often as children of older parents. This may be due to the competition between their transition to parenthood and the simultaneous transition to adulthood.

Age of the child was a significant moderator: weaker attachment transmission was found in younger children than in older children. Using IPD meta-analysis, it was possible for the first time to test this effect while controlling for differences between instruments as a confounder. Bowlby (1969/1982) suggested that internal working models are based on cumulative experiences with attachment figures, and that the cognitive models of attachment only become stabilized across a period of several years. Another interpretation would be that older children may be better able to draw on their parents' attachment representations for developing a parallel working model of attachment than younger children. That is, they might shape their own environment more due to the increasing person–environment correlation with growing age (Knafo & Jaffee, 2013). Of course, these are speculations about the development of the mechanisms of transmission with age, but ones that certainly warrant examination in future research, because the current findings suggest that the limited influences of parental inputs early on grow over time.

Fathers have been found to demonstrate lower levels of parental sensitivity than mothers (Hallers-Haalboom et al., 2017), which predict the attachment relationship with their child (Lucassen et al., 2011). Unexpectedly, however, sex of the parent did not moderate attachment transmission. While this finding may seem to run counter to the idea that attachment transmission may be constrained by amount of engagement parents have with their children, it may be that the traditional role division in which fathers have much less involvement with their children than mothers has become less characteristic over the years. Also, it should be noted that the number of studies on attachment involving fathers is still problematically low, and thus, this presents an important avenue for future research.

Contrary to our hypothesis, education level of the parent did not moderate the association between parental attachment representations and child–parent attachment. Even though we expected education level to serve as a proxy for socioeconomic status, this may not have been the case for all studies included in this meta-analysis. Some studies were performed several decades ago during a time when it was less common for individuals to pursue higher education (Barro & Lee, 2013). Moreover, it was more common in the past that women were primarily responsible for maintaining the household and raising the children, which may have negated the need for them to attain higher education. This may also be the case for studies that were conducted in rural areas or countries with limited access to education. It is possible that in these studies, the link between education level or socioeconomic status and sensitivity that was established by Biringen et al. (2000) was weak. However, this explanation is speculative and should be examined in more depth.

It is possible that the economic and time constraints of single parenthood may not pose a large enough constraint on attachment transmission. Perhaps, the effect depends on the presence of potentially buffering factors, such as a supportive social network or societal acceptance of single parenthood. These buffering factors could not be taken into account because data were not available in most of the studies. In future studies, data on potential risk and buffering factors in relation to single parenthood should be collected.

Study Strengths and Limitations

With the findings of the traditional meta-analysis (Verhage et al., 2016) pointing toward a more complex model of attachment transmission, theoretical progress requires methodological advances with increased statistical power for testing the various interactions between variables. The current study effectively demonstrated how the IPD methodology originally developed for achieving more precision in clinical efficacy trials (Tierney et al., 2015) and can be leveraged for answering fine-grained questions in observational study designs (Pigott, Williams, & Polanin, 2012). This evolution of meta-analytic methods is especially relevant for fields with a tradition of conducting highly focused studies and studies with standardized but labor-intensive measures and relatively small samples, such as the field of attachment research (Verhage et al., 2016).

Several strengths of IPD meta-analysis over traditional meta-analysis should be noted. First, a primary strength of IPD meta-analysis, especially using the current maximally informative option of one-stage analysis (combining all data in one data set for multilevel analysis; G. B. Stewart et al., 2012), is that it extracts more information from individual studies than conventional meta-analysis, because within-study variation in potential moderators of the focal effect is preserved, rather than eliminated through aggregation. This allows the examination of moderating variables that cannot be studied reliably in conventional meta-analysis due to large within-study variation, such as education level, age of the parents, and single parenthood in the current study. Furthermore, the availability of data on a participant level increases the power of moderation tests, limits multicollinearity problems with multiple moderators, and increases the range across which moderator values can be tested. As a result, the unique contribution of moderators relative to other moderators can be investigated in a more precise and robust fashion. In our case, this enabled us to demonstrate the moderating effect of child age when controlling for parental age and attachment measure, which was not possible in our previous conventional meta-analysis (Verhage et al., 2016). Also, IPD meta-analysis demonstrated that risk status only decreased the probability of attachment transmission for autonomous parents and not for nonautonomous parents. Finally, IPD meta-analysis allows for imputing missing study data (see Pigott et al., 2012). The results regarding the moderating effect of risk status and child age replicate and extend the conclusions by Verhage et al. (2016), thereby increasing the confidence in those findings. Thus, the advantages of IPD meta-analysis offset the disadvantages resulting from usually smaller total sample size than in conventional meta-analysis.

Some of the common weaknesses of IPD meta-analysis should also be discussed. The participation rate of 67% of eligible studies was high, given the difficulties that IPD meta-analysts have sometimes encountered when asking researchers to share their data (e.g., Jaspers & DeGraeuwe, 2014), also when taking into account that many of the studies were conducted decades ago (Polanin & Williams, 2016). For retrieval to be successful, issues related to ownership of data, security of data, informed consent, and opportunities for authorship have to be resolved. In all, collection of data took 2 years. Despite the large number of small samples that contributed data, harmonization of the primary study variables attachment representation and attachment relationship quality was relatively straightforward as a result of the field's persistent use of a small set of well-validated instruments, mainly the AAI and the SSP. Labs may vary in amount of training and extent of reliability in the use of these instruments, and such heterogeneity in statistical error may bias results, underlining the importance of sensitivity analyses with study quality indicators. There is little evidence that the differences in methodological quality among studies have influenced the findings. The one important exception was the interrater reliability of the AAI. As might be expected and as reported already in Van IJzendoorn's (1995) original meta-analysis, the effect size for attachment transmission was attenuated when AAI coder reliability was low. For cases with insufficient intercoder reliability, the odds of transmission and nontransmission were equal, whereas transmission was 4.5 times more likely in cases with sufficient intercoder reliability. It should be noted, however, that this analysis was performed on a small subsample (21% of the total sample, $N = 925$), as many studies did not report intercoder reliability. We, therefore, urge researchers to calculate intercoder reliability for all classification types and scale scores in future work.

Although research on attachment has been conducted for decades with similar measures across labs, it was nonetheless challenging to integrate the various data sets. One major obstacle was the harmonization of measures with diverging metrics. For example, child attachment can be assessed using categorical (e.g., SSP) or continuous variables (AQS), and to transform one type into the other requires somewhat arbitrary criteria for cutoff scores to create categories on the basis of continua. Second, IPD meta-analysis may lead to a smaller number of eligible studies and a smaller number of participants involved than the traditional meta-analytic approach. Therefore, statistical power of most IPD meta-analyses is certainly substantial, in particular for moderator analyses, but traditional meta-analysis might cover more studies resulting in a more representative picture of a research domain. In the current IPD meta-analysis, we were not able to include every study on parental attachment and child attachment because some raw data sets were not available. This was addressed by comparing the IPD meta-analytic results with results of aggregate data when raw data were lacking. Of course, the aggregate data were not directly incorporated in the IPD meta-analyses, but it enables a comparison of the overall effect size found using IPD meta-analysis with the effect size of the aggregate data.

Despite such limitations, IPD meta-analysis showed strengths that in combination with traditional meta-analysis might contribute to accelerated progress in research areas where small-scale studies are the rule rather than the exception. IPD meta-analysis stimulates researchers to join forces and cooperate more closely than some investigators are accustomed. In molecular genetics, in particular in Genome-Wide Analysis Studies, large consortia have emerged to integrate genomic data of tens of thousands of participants (e.g., the EAGLE consortium). In this era of skepticism about the replicability of published findings (Ioannidis, 2005), it is critical for the field of child development research to combine samples and share data, either post hoc with IPD meta-analysis or a priori, designing collaborative projects with carefully chosen converging assessments across study sites (an example being the NICHD study; NICHD Early Child Care Research Network, 1994). The increased statistical power compared to single studies reduces the risks for both false positives and false negatives and enables researchers to focus more on the strength and variability of effects than on the binary fact of its statistical significance. The Open Science movement (Center for Open Science, 2011–2017) is another reason to promote IPD meta-analysis. Researchers are increasingly asked to make their data publicly available. They are sometimes hesitant to do so because of the privacy of participants and because they would like to maintain control over the analyses of their carefully collected data. IPD meta-analysis research teams like CATS can guarantee both the privacy requirements and the justified wish of researchers to monitor and contribute to IPD meta-analyses that go beyond the limits imposed by a single study.

Like previous traditional meta-analyses have done (e.g., the "transmission gap" identified by Van IJzendoorn, 1995), the current IPD meta-analysis points toward new directions for primary studies. Now that ecological factors have been found associated with weaker transmission of autonomous representations to secure attachment, the mechanisms responsible for these constraints need to be identified and understood, for example, by testing whether family stress mediates this moderator effect (Conger et al., 2002) and in addition, what predicts child attachment (in)security in at-risk samples if not parental attachment representations. Also, given the potential implications of amount of time as facilitating transmission of autonomous as well as nonautonomous attachment, studies need to move beyond proxy variables and with help of ambulatory assessment index actual time in interaction as this variable may be determined by many factors, including aging, parental role divisions, and competing activities (e.g., McDaniel & Radesky, 2018). The current study also demonstrates the viability of IPD meta-analysis to answer questions in the field of attachment to address theoretical issues and to build models that capture small but (through their cumulative nature) important effects. This methodology opens up new avenues with regard to categorical versus continuous conceptions of attachment, interplay of constitutional and environmental factors, and variations in intervention efficacy, allowing continuous updating of effect sizes until desired precision is achieved and studies should rather shift their focus.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix S1. Detailed Information on the Study Selection and Data Selection Process

Appendix S2. Descriptives of the Ecological Constraint Variables and Correlations

Appendix S3. Results with Disorganized Attachment Included in the Insecure Category

Appendix S4. Comparison With the Aggregate Data